Remarks / Arguments

We readily accept your notion that the claims of the application were more or less literally translated from the German original of the PCT application into English. When handing it in, we were mistakenly afraid - as this is our first and yet only PCT application - to loose priority of our original application. In the meantime we are a little more familiar with the USPTO patent prosecution procedure. In the accompanying amendments of claims I have corrected some of the grammatical and idiomatic errors mentioned in your letter. We have even changed the spelling from the British English "reflexion" to the American English "reflection", since this has been mentioned as one of three examples of errors, although one might consider this not to be an error at all.

Additionally, I sincerely apologize for the indisputably more severe language errors and take your objection to the claims as they were originally filed as very helpful action for the process to improve the application and to better protect our invention. I am convinced that the amendment of claims included in this response puts them in an understandable form. I think that the amended claims now conform to current U.S. practice, and hope that our response to your action will lead to a improved protection for our invention as mentioned in §1 of the OA.

This said and with hopefully many errors corrected, I would like to focus on the contents of the invention, on the claims and on your restriction/election requirement in the above cited Office Action.

In your OA you argue that the invention uncovered in our application has to be separated into Groups I, II, and III, which relate to the use of two polarization layers (Group II with claims 9,19), three and more polarization layers without additional

folding in the light paths of the complementary polarization layers (Group I, claims 1-8 and 21-24) and three and more polarization layers with means of folding in the light paths (Group III, claims 10-18,20, 25).

We understand that your election/restriction requirement was caused by us formulating three independent claims in the filed application (1,9,10), with at least two of them so weakly formulated that they exclude each other. As we were advised in the OA, that our reply, to be complete, has to include an election of species, we want to elect Group I with claim 1 (in its amended form) and the claims which depend on claim 1 in the amended claims (2-8, 12-18,20-25). We withdraw claims 9, 10, 11 and19, to fulfill this requirement.

However, we would like to traverse the election/restriction requirement (37 CFR1.143).

We ask for reconsideration and withdrawal of the requirement, and want to provide the reasons and support our view with the following remarks:

The core of our invention has been triggered by our need for a symmetrical polarization process. With all simple polarizing beam splitters only one sub-beam of a polarization process is folded (reflected), and the polarization contrast of the reflected beam is much lower than that of the transmitting beam. If a higher polarization contrast was needed in the state of the art, the "less clean" reflected beam was guided to an "clean-up polarizer" to remove unwanted polarization components. Also, if there were images to be superposed and the folding in the reflected channel prevented this, a second folding was applied to the reflected channel. This asymmetry was further aggrevated by the fact that conventional MacNeille type polarizers have a plane of polarization of transmitted and reflected beam which is determined by the plane of incidence. Accordingly, "S"-polarization was always folded and of a lower polarization purity than "P"-polarization. This fixed relation was in some examples in the state of the art handled by the use of polarization rotating devices (e.g. half-wave plates), which however

introduce another layer of complexity and certain disadvantages. We found all these asymmetries to be unwanted in certain applications.

Recently available cartesian polarizers, e.g.wire grid polarizers - in contrast to Brewster-type polarizers- allow one to choose the plane of polarization of the transmitted (and, accordingly, of the reflected) beam independently from the plane of incidence. This eliminates one of the asymmetries of MacNeille type polarizers and led us to couple polarization processes in a way that has not been used or described before. Our invention is characterized by several couplings: a beam derived from polarizing transmission is guided to a second polarization process, in which it gets maximally reflected (coupling 1 of mutual complementary polarization processes) and a beam derived from reflection at a polarization process is guided to a second polarization process, in which it is maximally transmitted (coupling 2 of mutually complementary polarization processes). Moreover, these two couplings are themselfs coupled, in that the aforementioned sub-beams (the trans-ref beam and the ref-trans beam) are derived from the very same polarization process (which we denominate "reciprocal coupling"). Both sub-beams undergo exactly the same polarization procedures, and both have identical polarization contrasts and both undergo exactly one folding during the polarization processes.

This is the core idea of the invention, and we are after an extensive research quite positive that we are the first to describe it. Our view is also supported by the report of the WIPO (preliminary report on patentability - written opinion on the international searching authority).

Our application as it was originally filed to the USPTO lacked a method claim. In the international search report of the WIPO, it had already been suggested that a method claim might have facilitated the formulation of a generic claim covering the entire scope of the invention. We have tried to achieve this with the new claims (27,28) in the claim amendment included above.

The processes as described above can easily attributed to physical polarization layers. This, and the presumed use of our invention as an optical component led us to formulate utility claims, and some differentiation was formulated on the basis of the number of layers actually used to illustrate the different embodiments. In the following we will explain why this introduced unwanted exclusiveness of the claims before their amendment.

One of the polarization processes (the one which couples the two complementation groups) is definitely bound to one physical layer. In all drawings, this layer is denominated as P1 (Figs. 3,5,7,10,11). The other processes have been introduced and illustrated in our application to use a layer different from P1.

Group II (claim 9) had been formulated to cover a special case, where said two other processes are situated on a common layer. Thus this claim 9 had focused on the arrangement of two layers only. While the wording in fact implies exclusiveness, it is - in a well defined and illustrated embodiment - irrelevant to differentiate whether it is physically one or two layers. An obvious example is shown in Fig. 5B, where the three processes take place on 3 labelled layers (P1,P2,P3), but P2 and P3 are shown to be one material layer (their planes being identical and characterized by the same vector V2=V3). Accordingly, the same material indifference can be found in Fig 7B. Only by convention and for the sake of simplicity of reading and comparing the figure (it has to be compared to Fig.7A) it is labelled with 4 layer denominators (P1,P2,P3 and P4), while it is obvious that these four layers could be materially made of two layers, intersecting each other (again, P2=P3, and in addition, P1=P4), or, with a tiny intersection in one layer, could be made of three physical layers, or, with intersections in both, be realized with four layers. This is corrobarated also by Fig.8B, where the same physical line (physical layer) is refered to as P2 and P3, and the second line (physical layer) is labelled both P1 and P4. One more piece of evidence comes from Fig.10, where P2 and P3 are separated, but the polarizing layer in P1 and P4 is identical and could well be made of one material beam splitting layer. In all cases, coplanar

polarization sites (which we call layers Pi) can generally be located on one polarizing material layer. We are confident that this coplanarity of P2/P3 as described by the figures and in the text does not separate distinct inventions or put the necessity to assign them to distinct groups of inventions - Instead, we consider this coplanarity to be a restriction of the general core, and we hope that we can convince you to adopt our view.

This explained, we understand now that we were not wise to use the number of layers as a differentiating feature of claims 9 vs. claim 1/claim10. The amended elected claim 1 focuses on the geometric relations of the three PBS layers used in the standard form of the cross-polarizer. For this response and the amendment of claims we have elaborated a mathematical description of how the layers P2 and P3 with their polarizing vectors V2 and V3 are arranged relative to P1 with its V1 - carefully taking into account that the important polarizing layer vector V was introduced by our work, and thus has to be defined in the claim. Vectors and planes used in claim 1 are illustrated in Fig. 3.

We have show in Figs. 9 and 10 that - to our initial surprise - even conventional MacNeille type polarizer cubes can be used in our invention. The embodiment shown in Fig.10, as a MacNeille type PBS implementation of the four-armed cross polarizer, includes two foldings in one of the cross-polarizers. These foldings, and what they do to the planes of polarization are shown in Fig. 9, and explained as being optional elements to the core of our invention. The four-arm crosspolarizer, independent on the type of PBS used, always consists of two functional three-arm cross polarizers. Since one of the crosspolarizers does not contain foldings (the one comprising P1, P2 and P3), these foldings are not necessary parts of the cross-polarizer core, not even in the MacNeill type realization. Optional elements are part of most inventions and part of many US patents. It is hard to concieve that these optional parts require a separate divisional application. They are definitely not a mutually exclusively techniqual feature

as stated in §3 of the OA, if there had been a proper wording of the claims. In fact, claim 10 should include, but not exclude claim 1. Clearly, optical paths include optical axes, as formulated in claims 1,10. (Accordingly, group I should be included in group III). Or, differently put, group I (claim1) is a restriction of group III (claim 10).

We admit that a closer inspection of the claims could have given us this insight earlier - and that your action helped us to reach this understanding. In response to your action, we withdraw claims 9 and 10.

Once, after this optional feature of foldings in the optical paths of the complementary polarization couplings is introduced, another embodiment of the cross-polarizer is introduced that is, like the embodiments shown in Figs 5B,8B etc. made of only two layers. This embodiment is shown in Fig. 12. It only differs from Fig. 5B in the optional folding (by mirrors etc.) which is positioned such that P2=P3 is a second reciprocal coupling site of the two partial beams of P1. Differently put, the two polarizing layers are not only coplanar (in the same plane), but also have the very same location. We consider this to be an obvious and rather extreme restriction of the core of the invention!

We believe that part of the requirement for restriction/election was mainly derived by our formerly weak formulation of claims, which we agree suggested or even required the separation on mutually exclusive technical features. We understand especially that "at least three" excludes "two". Therefore, we have elected the amended claim 1, which now reads a precise "three", and have withdrawn claims 9 and 10. We have also added method claims as has been suggested to us by the WIPO recherche response. The new claims (27,28) are generic method claims which should cover the entire scope of the invention, without leaving the scope of the invention as described in the text and in the figures.

We sincerely ask you to consider our explanations and reconsider the restriction/election requirement and - in the case of a positive evaluation of our response

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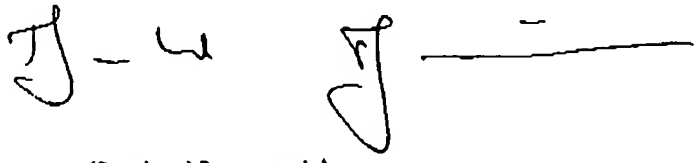
- to withdraw the requirement for the application with the amended claims.

Respectfully submitted, sincerely,



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